15

New York University
Progress Report No. 6
Constant Level Balloon
Section II
June 1947

PROGRESS REPORT #6

Covering Period from May 1, 1947 to
May 31, 1947

CONSTANT LEVEL BALLOON

Section II

Research Division, Project No. 93

Prepared in Accordance with Provisions of Contract
W28-099 ac-241, between
Watson Laboratories, Red Bank, New Jersey
and
New York University

Prepared by Charles S. Schneider

Approved by Professor Athelstan F. Spilhaus
Director of Research

Research Division
College of Engineering
June, 1947

I. The following new men were employed on the Balloon Project during May:

Name	Duties	Qualifications
J. Richard Smith	Meteorologist (full time)	Former Weather Bureau and Army forecaster. Taught weather equipment at New York University, M.S. in Physics-Meteorology, NYU.
William O. Davis	Balloon Performance Analyst (part time)	B.A. Physics, New York University. Former AAF pilot. Graduate student in Physics.
Fred Barker (rehired)	Equipment Construction (part time)	Undergraduate Aeronautical Engineering Student.

II. The following administrative action was taken during the month of May:

A bid was obtained from Skinner, Cook, & Babcock, Contractors, at 60 E. 42d Street, New York City, for the erection of a prefabricated building for the Balloon Project. The quotation of $4,000 was forwarded to Watson Laboratories.

Correspondence during this period was as follows:

Date of Correspondence	Address	Abstract	Answer
5/1/47	WIRE Dr. Frank Myers Lehigh University Bethlehem, Pa.	Use of football field requested for balloon launching on 6 May.	Granted.
5/5/47	WIRE Same	Bad weather postponed flight until 9 May.	None needed.
5/6/47	Kollsman Instrument Div. Square D Co. Elmhurst, L.I. Att: Paul Goudy	Request for quotation on diaphragm seal-off for dribbler and for increased quantity of modified dribblers.	Furnished.

5/7/57	WIRE Barney Frank Hightstown, N.J.	Samples of parachute shroud lines requested.	Furnished.
5/6/47	General Mills Minneapolis, Minn. Att: Mr. O. C. Winsen	Request for quotation on sample balloons shown to C.B. Moore on visit.	Awaiting Navy clearance.
5/13/47	Dewey & Almy Chem. Co. Cambridge, Mass. Att: Mr. Isom	Request delivery date on 1000 gm balloons.	Given.
5/14/47	Mr. C.P. Clare 4719 W. Sunnyside Ave. Chicago, 30, Ill.	Request for information and catalogues on rotary switches.	Furnished.
5/14/47	Goodyear Tire & Rubber Akron, Ohio Att: Leonard M. Harb	Delaying action in Goodyear's quotation for balloons.	
5/15/47	Office of the Secretary Fort Worth Sub-Committee on Air Space Civil Aeronautics Authority, (4th Region) Fort Worth, Texas	Request clearance for flight of Balloons from Alamogordo.	Given.
5/27/47	General Mills Minneapolis, Minn. Att: Mr. O.C. Winsen	Repeat request for quotation on plastic balloons.	Awaiting Navy clearance.

IV. Conferences

The following conferences were held during the month of May:

Date	People Present	Where Held	Discussed	Conclusions
5/1/47	O. C. Winsen of General Mills	General Mills Minneapolis, Minn.	Manufacture of balloons by General Mills for this project.	Obtain Navy clearance General Mills balloons look good for our work.
5/8/47	Dr. Peoples, Mr. Ireland, of Watson Laboratories. C.S. Schneider, C.B. Moore	Watson Laboratories Red Bank, N.J.	Bethlehem flight for May 9.	Final details.
5/10/47	Same	Same	New flights at Alamogordo, N.M., where lower winds can be found.	Set up trip to Alamogordo for May 29.
5/13/47	Paul Goudy of Kollsman Instrument C.B. Moore	Kollsman Instrument Div. Square D Co. Elmhurst, L.I.,N.Y.	New dribbler design.	
5/14/47	Representative of Vulcan Proofing Co. C.S. Schneider, C.B. Moore	Vulcan Proofing Co. Brooklyn, N.Y.	Testing of balloon fabrics and films.	Vulcan proofing would make tests.
5/22/47	Dr. Peoples, Messrs: A.H.Mears, John Alden, Charles Ireland, C.S.Schneider, C.B. Moore	Watson Laboratories, Red Bank, N.J.	Final arrangements for Alamogordo trip.	

III C 1. General Work Accomplished

A conference was held on May 1 at Minneapolis with Mr. O. C. Winzen of General Mills concerning the manufacture of balloons by General Mills for this project. At the present time this company cannot supply us with balloons until Navy clearance is obtained, but it is hoped that arrangements can be completed in the near future. The type of balloons manufactured by General Mills seems to be well suited to the needs of this project.

On May 8 a trip was made to Lehigh University, Bethlehem, Pa., to fly a cluster of meteorological balloons carrying Watson Laboratories equipment. Winds developed during launching and the balloons escaped when the restraining lines snapped under the strain, carrying balloons aloft without payload.

As a result of this incident, two conslusions were drawn: first, that a new launching technique was needed; second, that another launching site must be selected offering consistently calm winds during launching. It was decided to make the next flights at Alamogordo, New Mexico, early in June.

On May 14 a conference was held at the Vulcan Proofing Co., in Brooklyn, N.Y. to discuss the possibility of this company testing various types of fabric and film used in the manufacture of balloons. It was agreed that the company would make the desired tests when ordered by us.

The high point of the month's activities was the departure for Alamogordo on May 31, and the balance of the month was spent in the preparation of equipment for the flights to be made there. Depature was made from Olmstead Field, Middletown, Pa. in a C-47 furnished by the Watson Laboratories.

2. Specific Problems

In general, problems remain the same as those discussed in the previous report, namely: the determination of the relative merits of various balloon films and fabrics available; the analysis of the altitude control devices to be used; and the flight testing of the equipment to be used in preliminary work. All of these problems now await further flights and delivery of equipment ordered before solution can be attempted.

3. Limitations

The greatest hindering factor in the progress of work is the lack of available space. The prefabricated building to be furnished by the government under the terms of the contract is now more urgently

needed than before, due to the hiring of more personnel. The joint laboratory and office which this project shares with another is highly inadequate for six men of theirs and eleven of ours -- a total of 17 men in a space approximately 15x15 feet.

d. Methods of Attack

Until plastic balloons can be obtained, we will continue to fly clusters of meteorological balloons.

e. Apparatus and Equipment

The only substantial change in equipment during the period covered by this report, other than general strengthening of flying lines, is the addition of a new main sand ballast dropping device to the equipment train of the flights to be made at Alamogordo.

The device consists of a nest of eight plastic tubes each filled with dry sand and sealed on the bottom with a sturdy paper membrane. At the bottom of each tube, resting against the membrane, is a small detonating squib of sufficient force to rupture the paper and permit the sand to fall. Each squib is connected to a different lead on the baro-switch of a radio-sonde modulator, so that a predetermined weight of sand may be released at eight predetermined altitudes. A small wire "shelf" is placed over the commutator of the modulator in such a way that the pin arm is lifted clear of the contacts during ascent and permitted to drop into place at an altitude above that of the highest firing contact. This is designed to prevent the firing of squibs and consequent dropping of ballast during ascent.

f. Conclusions and Recommendations

It is felt that the use of freely extensible meteorological balloons is unsatisfactory for any final solution of our problem because of their inherent instability and the rapid deterioration of neoprene rubber under the rays of the sun. It is felt that cluster flights of these balloons are a purely stop-gap method of floating Watson Laboratories equipment until plastic non-extensible balloons can be obtained and tested.

The need for greater work space is becoming increasingly urgent as new personnel are added to the project and the extent of the work grows.

It is believed that with present equipment the Alamogordo, New Mexico, area is the most suitable available for launching purposes, since calm winds are consistently present at dawn, and there are a minimum of clouds to impair ground observation of the balloons in flight.

Future Work

It is hoped that in the immediate future satisfactory techniques for the launching and floating of cluster flights may be developed under optimum conditions, and tests made on small plastic balloons to be furnished by H.A. Smith, Coatings, Inc., of Mamaroneck, New York.

Arrangements have been completed with the Vulcan Proofing Co. of Brooklyn, N.Y. to test various balloon fabrics and films available. These tests will probably be conducted in the near future.

As soon as arrangements can be completed to obtain Navy clearance we plan to obtain non-extensible balloons from General Mills in sufficient quantity to make flight tests and commence work on the ultimate objective of this project.

16

New York University
Special Report No. 1
Constant Level Balloon
May 1947

See also
Weaver Attachment 25

SPECIAL REPORT #1

Covering Period from January 1, 1947
to April 30, 1947

CONSTANT LEVEL BALLOON

Research Division, Project No. 93

Prepared in Accordance with Provisions of Contract
W28-099 ac-241, between
Watson Laboratories, Red Bank, New Jersey
and
New York University

Prepared by: Charles S. Schneider
Charles S. Schneider
Assistant Project Director

Approved by: Renato Contini
Renato Contini
Acting Director of Research

Research Division
College of Engineering
May, 1947

ABSTRACT

A preliminary survey was made of the problem. Specifications were drawn up for the equipment needed and manufacturers were contacted to construct experimental balloons and altitude controls.

A balloon crew was assembled.

While awaiting delivery on the NYU designed equipment, clusters of meteorological balloons have been flown for experience and as a stop-gap method of carrying a payload to altitude. In addition, two salvaged, racing-type, man-carrying balloons of 35,000 cubic foot size have been procured and are being prepared for flight. Two 19,000 cubic foot Japanese balloons have been made available by the Navy.

Preliminary calculations have been made on balloon buoyancies and families of curves plotting altitude vs. lift for various balloon sizes have been prepared for planning and flight purposes.

Civil Aeronautics Authority has given clearance for flight of large balloons form Lakehurst, New Jersey, and Bethlehem, Pennsylvania, with certain restrictions.

REPORT

I. The personnel working on this project consists of the following full-time employees:

Name	Duties	Qualifications
Charles S. Schneider	Asst. Proj. Director	Former weather equipment officer, Army Air Forces doing similar work during the war. Elec. Engineering, Brooklyn Polytechnic & NYU
Charles B. Moore Jr.	Research Engineer	Former weather equipment officer, Army Air Forces doing similar work during the war. Graduate of Georgia School of Technology in Chemical Engineering.
Richard Hassard	Chief of Flight Detail	Former Signal Corpos Officer, Elec. Engineering at NYU.
Murry Hackman	In charge of the Electronic Weather Equipment.	Former weather equipment Technician, Degree in Mathematics and Statistics City College of New York.

In addition to the above full-time employees, the following part-time personnel are now working on the project:

Name	Duties	Qualifications
Henry Kammenzind	Computations & Equipment Construction	Undergraduate Elec. Engineering Student.
Ralph Morrell	Equipment Construction	Undergraduate Admin. Engineering Student.
James Smith	Weather Observer and Draftsman	Former Weather Observer in Army and Undergraduate Engineering Student.
William Kneer	Machinist	Undergraduate Engineering Student.

The following personnel were hired but later resigned:

Name	Duties	Qualifications
Robert Wisnieff	Equipment Construction	Undergraduate Physicist Student.
Robert Ferris	Equipment Construction	Undergraduate Physics Student.
Fred Barker	Equipment Construction	Undergraduate Aeronautics Engineering Student.

II. The following administrative action has been taken in connection with this contract:

Personnel

1. The assignment of Charles S. Schneider to act as Assis-ant Project Director.

2. The employment of Charles B. Moore Jr. of Georgia Tech. as a Research Assistant with duties as Engineer.

3. Murry Hackman was engaged to take charge of the Electronic weather equipment due to his past experience as a weather equipment technician and as an instructor of the AAF classes in the maintenance of radiosonde receptor AN/FMQ-1 and radio directional finder SCR-658 at Chanute Field, Illinois.

4. Richard Hassard, a former Signal Corps Officer was hired because of his general knowledge of electrical and radio circuits to handle the construction of special flight equipment.

Equipment

5. As New York University did not possess all the necessary equipment a list of equipment was prepared and submitted to the Government with the request that this equipment be loaned or furnished

by the government. To date most of this equipment has been received with the exception of the AN/FMQ-1, SCR-658 and the prefabricated buildings needed for office and storage space.

6. The list of equipment that was submitted to the government consisted of the major items that were necessary. However, because many small hand tools and radio parts and other equipment were needed periodically a petty cash fund of $100 was set up to facilitate purchase of small items. A further request has been submitted to the Chancellor of the University requesting that this petty cash be increased to $200 and that a travel fund of $100 be established.

Housing

7. The existing inflation shelter at the school for the Meteorological Department's use was not adequate to handle the large diameter plastic balloons that we plan to use. Therefore a request was submitted and approved by the Contracting Officer for the construction of a 27 ft. cube inflation shelter on the campus of New York University. Due to restrictions placed on us by the Air Space Sub-Committee of the Civil Aeronautics Authority, New York Office, it has since been decided not to erect this inflation shelter in the New York area, but rather to use existing facilities at Lakehurst, New Jersey or Olmstead Field, Middletown, New Jersey.

Sub-Contracts

8. Permission was secured from the Contracting Officer of the Watson Laboratories to place two sub-contracts. One was for the fabrication of plastic balloons and was placed with Harold A. Smith Inc., of Mamaroneck, New York. This sub-contract amounted to $7,565. The second sub-contract was placed with Kollsman Instrument Division of

Square D Incorporated at Elmhurst, Long Island, New York. This sub-contract was for the construction of model altitude controls and amounted to $7,446.

Correspondence written during this period is as follows:

Date of Correspondence	Address	Abstract	Answer
11/7/46	Plax Corp Hartford, Conn. Att: Mr. Griffith	Forwarding P.O.#5983 & Requesting price quotation and delivery schedule for 4 diff. thicknesses of 36" wide polyethylene sheet (.001" .00225" .004" and .008".	Not furnished.
11/7/46	Visking Corp. Chicago, Ill. Mr. Cahn	Request to know what maximum width Polyethylene could be supplied in, and what the cost and delivery date would be.	
12/4/46	Visking Corp. Chicago, Ill. E. B. Cahn	Advising interest in securing 300 ft. of 72" circumference polyethylene tubing request information on thickness and price.	72" circumference Polythylene tube could be furnished. Request to know quantity and thickness .002 mil thick $1.40/lb. estimate and would need 19 lbs.
12/10/46	Dewey & Almy Chem. Co. Cambridge, Mass. Att: Mr. Langley W. Isom	Acknowledging receipt of material used by Mr. Isom in his constant level balloon work. Also advising that order for single and double neck 1000 gram balloons had been placed.	None required.

12/16/46	Celanese Celluloid Corp. 180 Madison Avenue New York, N. Y.	Advising this company of our desire to fabricate a balloon from plastic film and our interest in ethyl cellulose as a possible plastic film to be used for this construction. Request that literature be supplied showing low temperature characteristics, tensile strength, etc.	Advising they do not believe ethyl cellulose would work secondly that they do not make film only molding powder - no literature available.
12/17/46	Nixon Nitrogen Works Nixon, New Jersey	Same request made of this company as with Celanese Celluloid Corp.	Advising they only make molding powder.
12/17/46	Plax Corp. Hartford, Conn. Att: Mr. Griffith	Advising that E. L. Cournand Co., recommended by Plax, had declined the contract for fabrication of balloons. That Unexcelled Chem. Corp. of New Brunswick had agreed to this fabrication and supplied the necessary shipping address for the polyethylene.	None required.
12/17/46	Dewey & Almy Chem. Co. Cambridge, Mass. Att: Mr. Isom	Acknowledging receipt of single and double neck balloons. Double neck balloons were received with a single neck plus a nub on the top of the balloon. Request to know whether shipment was in error and if so what disposition to be made.	Advising that nub must be cut with scissors in order to get double neck.
12/17/46	Dow Chem. Co. Midland, Mich.	Same request made of this company as that made with Celanese Celluloid Corp.	Not received.

12/24/46	Unexcelled Chem. Corp. Harold A. Smith	Advising the Plax Corp. had been supplied with his shipping address and also requesting his technical advice on the feasability of using a 72" wide strip of polyethylene, 2 mil. thickness that Visking Corp. of Chicago could supply.	Advising that .002 mil thickness too thin. Suggested endeavoring to obtain 72" width in .006 mil.
1/3/47	Harold A. Smith	Acknowledge receipt of letter of December 26th containing estimated cost of fabrication of balloon. Advising that the bid could not be accepted on a cost plus basis. Requesting that their quote be resubmitted.	New quotation furnished.
1/3/47	Visking Corp. Chicago, Ill. Att: J. L. Lane	Advising that fabrication of balloons at a 2 mil. thickness polyethylene film would be extremely difficult to handle. Request made that information be supplied on a 72" circumference film 4-6 mils in thickness.	Advising that they only have .004 and .006 15 18" flat width. The 36" width request could be made but price would be prohibitive.
1/8/47	Watson Laboratories Red Bank, N. J. Mr. A. H. Mears	Advising need of radiosonde receptor SCR658 by NYU plus power units and technical publications.	Advising part shipment would be made Feb. 13th.
1/8/47	Watson Laboratories Red Bank, N. J. Mr. A. H. Mears	Returning list of equipment to the government loaned or government furnished with request that certain corrections, additions and deletions be made.	Advising government records changed and that catalogues will be sent under separate cover.

1/14/47	Bland Charnas Inc. Yonkers, N. Y.	Requesting to know whether this company would consider fabrication of 15 ft. diameter plastic balloon.	Advising that they could not assist us in fabrication.
1/21/47	Shellmar Projects Corp. Mt. Vernon, Ohio	Request that they quote on delivery and cost of fabrication of 10 ea.15 ft. balloons. Five to be fabricated from Saran (Type M.00225" thick and 5 from polyethylene made from PM-1.004" thick.	Advising plant could not cope with problem at this time.
1/21/47	Milprint Inc. Milwaukee, Wisc. Mr. Paul B. Hultkrans	Same request as letter to Shellmar 1/21/47.	Verbally informed. Not interested.
1/21/47	Rowe Packaging Co. Ltd. Toronto, Canada	Same request as letter to Shellmar 1/21/47.	Wish to make model and submit same before quoting. Never heard anything.
1/21/47	Western Products Inc. Newark, Ohio	Same request as letter to Shellmar 1/21/47.	Acknowledged receipt of letter and advising quotation would follow. Did not arrive.
1/23/47	Kennedy Car Liner & Bag Co., Inc. Shelbyville, Ind.	Same request as letter to Shellmar 1/21/47.	Verbally informed. Not interested.
1/23/47	Unexcelled Chem. Corp. Harold A. Smith	Request for quote on 15-15 ft. diameter balloons and 6-3 ft. diameter balloons to be fabricated from various thicknesses of Saran and Polyethylene.	New quotation furnished.
1/23/47	Watson Laboratories Red Bank, N. J. Mr. A. H. Mears	Advising that tool equipment TE-50A was short a 6" ruler a pr. of tweezers, and a socket wrench. No request for replacement for these items made.	None required.

1/28/47	Kollsman Instrument Co. Elmhurst, L. I. Att: Paul Goudy	Request for quotation of 3 ea. of the following altitude control equipment: 1. Motor switched modulators. 2. Elec. controlled dribblers. 3. Mech. controlled dribblers.	Quotation supplied.
2/3/47	Contracting Officer Watson Laboratories Red Bank, New Jersey	Forwarding quote from Unexcelled & requesting approval.	Not approved.
2/7/47	Watson Laboratories Red Bank, New Jersey Att: Mr. D. Rigney	Requesting permission to build a 27 cubic foot inflation shelter.	Permission granted.
2/10/47	Contracting Officer Watson Laboratories Red Bank, New Jersey	Forwarding quotation received from Kollsman Instrument Co. for the necessary control devices for the constant level balloon.	Permission granted to place subcontrac-
2/11/47	Patterson Bros. New York City Att: Mr. H. Carey	Advising that one Ungar electric soldering pencil is being returned under separate cover as it was received in unusable condition. Request for replacement made. Quotation enclosed.	Replacement made.
2/18/47	Contracting Officer Watson Laboratories Red Bank, N. J.	Requesting permission to place subcontract with Unexcelled Chem. Corp. for the fabrication of balloons.	Permission withheld.
2/24/47	General Mills Minneapolis, Minn. Mr. O. C. Winzen	Request that quotation be supplied for the fabrication of 15-15 ft. diameter balloons and 6-3 ft. diameter balloons made of various thicknesses of polyethylene and Saran.	Declining to quote until after conference with NYU representatives.

2/24/47	Bland Charnas Co. Inc. New York City	Same request as letter to General Mills 2/24/47.	No reply received.
2/24/47	Leonard M. Harb Goodyear Tire & Rubber Akron, Ohio	Same request as letter to General Mills 2/24/47.	Quotation supplied 15 April 1947. No answer received.
3/6/47	Watson Laboratories Red Bank, N. J. Mr. Brophy	Forwarding copy of letter of request that had been sent to Mr. H. A. Smith for the fabrication of balloons.	
3/7/47	Contracting Officer Watson Laboratories Red Bank, N. J.	Advising that Unexcelled Chem. Corp. did not wish to proceed with the contract and that instead H. A. Smith of Mamaroneck, N. Y. was willing to undertake the fabrication. Quotation from Mr. Smith enclosed. Request that approval be granted.	Permission granted.
3/7/47	Goodyear Tire & Rubber Akron, Ohio Mr. L. M. Harb	Request a quote on the fabrication of 5 ea. balloons made from Nylon covered with suitable neoprene and 5 ea. balloons made from fortisan covered in a similar fashion. Advising that any recommendations concerning balloon fabrics would be appreciated.	Quotation supplied 15 April 1947.
3/7/47	Seyfang Laboratories 1300 Mediterranean Ave. Atlantic City, N. J.	Same request as letter to General Mills 2/24.	Advised interest. Ask for conference.
3/7/47	Unexcelled Chem. Corp. New Brunswick, N. J.	Requesting that polyethylene film that had been shipped to them from Plax Corp. be returned to NYU.	No action taken.
3/7/47	Plax Corp. Hartford, Conn. Mr. R. E. Ames	Request that shipping address for polyethylene film be changed from Unexcelled Chem. Corp., New Brunswick, N.J. to H. A. Smith, 490 Bleecker Ave., Mamaroneck, N.Y.	No answer required

3/19/47	Unexcelled Chem. Corp. New Brunswick, N. J. Att: Mr. Tegen	Confirming telephone conversation in which authorization was given to ship polyethylene film to NYU and advising once again of correct shipping address.	Film shipped. Quotation supplied.
3/21/47	Manne-Knollton Insul. Co., N. Y. C.	Requesting quote and delivery date on fibre screws 1¼" long, fillister head and 8-32 thread.	Quotation supplied.
3/24/47	General Mills Minneapolis, Minn. Mr. O. C. Winzen	Acknowledge letter of 3/11 and advising that our representatives would be pleased to discuss construction details of the balloons.	Asked for conference in April.
3/24/47	Mr. R. S. Hassard 5 Hollywood Ave. Tuckahoe, N. Y.	Advising him of possibility of full-time position in Research Div. of NYU. Requesting that he make appointment for interview.	Hassard employed.
3/25/47	Mr. George E. Weidner Engineer Board Barrage Balloon Branch Ft. Belvoir, Va.	Requesting permission for NYU representatives to visit with him to discuss constant level balloons and safety valves and control devices.	Invited to visit Mr. Weidner.
3/27/47	H. A. Smith Mamaroneck, N. Y.	Requesting quote on valves.	Supplied
3/29/47	H. A. Smith Mamaroneck, N. Y.	Request for quote on balloons fabricated from nylon and fortisan film coated with butyl rubber.	Not received.
3/29/47	Seyfange Laboratories 1300 Mediterranean Ave. Atlantic City, N. J.	Requesting quote on 3 sets of stabalizer fins.	Received.

3/31/47	J. R. Garvin Douglas Leigh Sky Advertising Co. Lakehurst, N. J.	Requesting quote for the 80,000 cu. ft. balloons that this company received from surplus.	Acknowledged. Asked for definite express ion of interest.
3/31/47	Seyfang Laboratories 1300 Mediterranean Ave. Atlantic City, N. J.	Requesting quote on one to five each 15 ft. diameter balloons made of 3 oz. silk cloth coated with neoprene and 2 each 3 ft. diameter balloons made from the same material.	Furnished.
4/1/47	Mr. J. Boyle Air Cruisers Inc. Clifton, N. J.	Requesting quote on 25-15 ft. diameter balloons and 10-3 ft. diameter balloons made from polyethylene .004" polyethylene .008" saran .00225" and a fortisan fabric coated with butyl rubber and from nylon film.	Quote furnished on nylon fabric coated with butyl rubber. Interested but want cost plus basis.
4/1/47	Molded Latex Products Inc. Paterson, N. J.	Identical letter as above request to Air Cruisers Inc.	Furnished.
4/8/47	WIRE H. J. Brailsford & Co. Inc. Rye, N. Y.	Requesting price and delivery date of 3 volt price type relays.	
4/8/47	Capt. Albert C. Trakowski Watson Laboratories Red Bank, N. J.	Forwarding minutes of Air Space Sub-Committee Meeting.	None required.
4/8/47	General Mills Minneapolis, Minn. Mr. O. C. Winzen	Acknowledging receipt of March 31st letter and notifying this company that our representatives would be pleased to come at their convenience.	April date set.
4/10/47	WIRE H. G. Brailsford Rye, N. Y.	Requesting to know how relays ordered were shipped.	Answered.
4/10/47	WIRE Lehigh University Bethlehem, Pa. Prof. Frank Myers	Requesting permission to make balloon release from Lehigh University on 15 April.	Given.

4/10/47	WIRE Seyfang Laboratories 1300 Mediterranean Ave. Atlantic City, N. J.	Requesting to know whether April 17th or 18th would be satisfactory to Mr. Frank C. Seyfang to meet NYU representatives to inspect 80,000 cu. ft. and 2-35,000 cu. ft. in Heightstown, N. J.	Date Given.
4/11/47	WIRE Dewey & Almy Cambridge, Mass. Mr. W. L. Dawbarn	Advising that single neck N1000 gram balloons should be furnished on our order 148-48.	None needed.
4/14/47	WIRE Frank Seyfang Seyfang Laboratories Atlantic City, N. J.	Advising NYU representative could not keep engagement for April 17th to inspect balloons and requesting that next best suitable date be furnished.	Furnished.
4/15/47	WIRE Mr. Barney Frank 27 Rochdale Ave. Roosevelt City, N. J.	Advising NYU still interested in purchase of balloons. Requesting that inspection date be changed from 17 Apr. to 23 Apr.	Satisfactory
4/17/47	WIRE Lehigh University Bethlehem, Pa.	Advising time of arrival at Lehigh to release balloons.	None needed.
4/17/47	N. Y. Sub-Committee on Air Space 385 Madison Ave., NYC Att: C. J. Stock	Advising that discrepancies observed in minutes of CAA meeting and requesting that conditions for more suitable flights be granted.	Request refused.
4/21/47	WIRE General Mills Minneaplis, Minn. Mr. O. C. Winzen	Advising that NYU representatives would make definite date for arrival later in week.	

4/21/47	WIRE Barney Frank 27 Rochdale Ave. Roosevelt City, N. J.	Confirming date of Apr. 23 for date inspection of balloons.	None needed.
4/21/47	Seyfang Laboratories Atlantic City, N. J.	Confirming date of 23 Apr. for date inspection of balloons.	Answered.
4/23/47	Kollsman Instrument Division 80-08 45th Avenue Elmhurst, L. I.	Changing details in altitude control purchase order.	None needed.
4/28/47	WIRE Seyfang Laboratories Atlantic City, N. J.	Advising that 2 - 35,000 cu. ft. balloons were purchased from Barney Frank and that these balloons were being shipped to him for repair.	Acknowledged.
4/28/47	Barney Frank 27 Rochdale Ave. Roosevelt City, N. J.	Advising that University would buy 2 - 35,000 cu. ft. balloons and that these balloons should be shipped to Seyfang Laboratories.	Acknowledged.

IV. Conferences

Preliminary conferences were held with plastic packaging companies. However, as trained personnel were not always available at the time of these conferences with the various companies it was necessary to write followup letters. Reference to these letters can be found under communications of this report.

In addition to these preliminary conferences regarding plastics the following conferences were also held:

Date	People Present	Where Held	Discussed	Conclusions
2/11/47	Dr. J. Peoples, C. Ireland, D. Rigney, Capt. Trakowski, Hackman, Moore, Schneider	Watson Laboratories Red Bank, N. J.	Government furnished equipment.	Equipment would be expedited by Watson.
2/21/47	R. Brophy, Dr. J. Peoples, Capt. Trakowski, D. Rigney, Schneider, Moore	Watson Laboratories Red Bank, N. J.	Placement of sub-contracts for balloons with H. A. Smith, Inc.	NYU should visit Goodyear before placing contract.
2/25/47	Lt. Comdr. Harrison, Dr. Peoples, Schneider, Moore, Hackman	Lakehurst Naval Air Station Lakehurst, N. J.	Jap Balloons.	Jap balloons were available for projecture.
2/27/47	J. Sturtevant, L. Harb, Schneider, Moore	Goodyear Tire & Rubber Co. Akron, Ohio	Fabrication of large balloons	Goodyear was interested and would prepare a quote.
3/3/47	Dr. Peoples, D. Rigney, Moore, Schneider	Watson Laboratories Red Bank, N. J.	Placement of sub-contracts for balloons and altitude controls.	Permission granted to place sub-contract.
3/21/47	Mr. Hagen, Dr. Prendergast, Moore	Molded Latex Paterson, N. J.	Fabrication of large balloons.	Await preparation of a quote.

3/25/47	Lt. Gunther, Comdr. Harrison, C. Ireland, Moore	Lakehurst Air Naval Station Lakehurst, N. J.	Use of Lakehurst as a launching site.	Lakehurst would be available to Watson.
3/26/47	F. Seyfang, Mrs. F. Seyfang, Moore, Schneider	Atlantic City, N. J. Seyfang Laboratories	Fabrication of large balloons.	A quotation would be prepared.
4/4/47	Dr. Peoples, D. Rigney, Moore, Schneider	Watson Laboratories Red Bank, N. J.	1st Cluster Flight	Prepare for Second Flight
4/11/47	R. Brophy, Mr. Cambridge R. Contini, M. Giannini Schneider, Moore	New York University	Contract Administration	Housing would be provided by govt.
4/30/47	P. Goudy, Moore	Kollsman Instrument Co. Elmhurst, L. I.	Ballast valve construc- tion.	Change inddetails.

During the period covered by this report, Messrs. Moore and Schneider made repeated trips to Kollsman Instrument Co. and discussed the fabrication of the modulators and other equipment that Kollsman was designing for our use. These meetings have not been considered conferences but for the benefit of this report the same individuals were always present, Messrs. Schneider and Moore of New York University and Paul Goudy, Engineer fo r Kollsman Instrument Co. The material discussed was methods of improving the construction of the modulators and other equipment.

III C 1. General Work Accomplished.

The period was spent in preparatory work which consisted of the following phases:

Phase 1. The designing of a balloon and of altitude controls to be used as tentative solutions to the main problem.

2. The contacting of plastic film fabricators to obtain several sources of supply for large non-extensible balloons. To date, one subcontract has been let for 15 ft. diameter balloons.

3. The contacting of an instrument company which would construct the altitude control devices. A subcontract has also been let for altitude controls.

4. The designing of a large balloon inflation shelter at N. Y. U. Materials have been procured for it. Due to change in plans the shelter will not be built at N. Y. U. therefore the materials are being held for the government until termination of contract.

5. The repairing and testing of the radiosonde receptor in Department of Meteorology for preliminary flights pending the arrival of Government-loaned equipment.

6. The preliminary flights with clusters of Meteorological balloons as stop-gap methods to attempt constant level balloon flights while awaiting the delivery of N. Y. U. designed equipment.

7. The making of preliminary calculations and requirements on constant level balloon performance.

2. Specific Problems.

Yet to be determined is the relative merits of various balloon films and fabrics available. This is to be handled by test work done by

the General Mills and perhaps by the Bureau of Standards in Washington.

The altitude control devices need to be analyzed for determination of optimum settings for initial action and rates of release of the ballast. This problem is awaiting some flights before a full scale, mathematical study is undertaken.

The main problem is the flight testing of the equipment planned as a tentative solution to the desired flight path. This awaits receipt of some large lightweight balloon envelopes and more of the altitude controls.

3. Limitations.

More work would have been accomplished had the equipment to be furnished by the Government arrived. The prefabricated building that is to be supplied by the Government according to the contract is urgently needed, as there is no housing available for the project at N. Y. U. The project personnel has been using work benches occupied by other projects. The project has been using the office space of another research group. This has not been satisfactory as six of their men and four of ours attempt to work in a joint laboratory and office 15 x 15.

Restriction on the project is the Civil Aeronautics Authority requirement that balloon flights be made only on days that are cloudless up to 20,000 feet. This is difficult to meet in the eastern United States but appears less difficult in the New Mexico area.

The pertinent abstract from minutes of the meeting with the Air Space Sub-Committee of CAA on 17 March 1947 are included in the appendix.

d. Methods of Attack

(1) After a survey of available literature in aerostatics and after conferences with various balloon manufacturers and authorities it is believed that the basic problem of maintaining the 15 lbs. of payload at constant altitude can best be solved by using a non-extensible balloon and a device operated by pressure which drops ballast whenever the balloon descends below a preset altitude.

The specifications for the equipment are as follows:

The balloon should be of large known volume, light in weight, non-extensible, either transparent or highly reflective to solar radiation. Rigging should be used to distribute the load evenly about the balloon.

A safety valve should be used to hold the inflation appendix of the balloon normally closed (as any hydrogen lost decreses the time possible at nominal constant altitude). The valve would act as a safety vent if the balloon should rise appreciably above the altitude where it is fully inflated, as there is danger of rupturing the envelope unless the excess pressure is relieved. The safety valve should be set to release pressure before the limit of the working stress of the balloon fabric is reached.

If the exact volume of the balloon is known and the air density vs. altitude relationship is determined on the day of flight, it is possible to compute the total lift of the gas in the balloon at any altitude. By adjusting the gross load to be supported by the gas to equal the total lift at the desired altitude of flight, the balloon will level off at the desired

altitude as it has no further buoyancy. This altitude stability exists only as long as the balloon is in the fully inflated or "taut" state. Once the balloon starts descending (due to loss of hydrogen by diffusion or by other loss) it becomes flabby and is no longer stable. It will continue descending until corrective action is taken or until it reaches the earth.

The altitude control is to be used is the ballast valve. When correctly set it will determine the lower limit of the balloon's oscillation as it would release a free flowing liquid ballast from a reservoir whenever the balloon descends a short distance below a preset altitude.

To test this tentative solution to the basic problem, intermediate sizes of balloon made of suitable fabric or films are needed in addition to the altitude controls.

Balloons

Balloon manufacturers and fabricators of plastic films were contacted to locate a suitable balloon material. The following materials were suggested:

Material	Advantages	Disadvantages	Disposition
Plastic Film			
Polyethylene	Good low temperature properties (Gen.Mills desires to fabricate Picard's balloons from this).	Low tensile strength, Milky-translucent, Medium permeability.	10 ea. 15 ft. balloons being fabricated from it.
Saran	Transparent, low permeability, high tensile strength.	Tears easily, fair low temperature properties (?), weak at seams if heat sealed.	5 large balloons being fabricated.

Nylon	Good low temperature properties, easily fabricated, strong.	Not available, low tear resistance (?)	Awaiting sample.
Vinylite	Easily fabricated. Almost transparent.	Very poor low temperature properties.	Discarded.
Teflon	Strong	Can not be fabricated.	Discarded.
Ethocel	Easily fabricated. Good low temperature characteristics.	Very high permeability.	Discarded.
Pliofilm	Easily fabricated.	Poor ultra violet properties, poor low temperature properties.	Discarded.
<u>Coated Fabrics</u>			
Nylon coated with neoprene butyl rubber polyethylene saran	Strong, easily fabricated.	Heavy, expensive opaque, nylon cloth has relative high elongation.	Awaiting Investigation.
Fortasin (regenerated celulose rayon) coated with neoprene butyl rubber polyethylene saran			Awaiting Investigation.
Silk coated with neoprene butyl rubber			Awaiting Investigation.

As a result of this preliminary study a sub-contract was given to H. A. Smith, Coatings Inc. of Mamaroneck, New York, to fabricate balloons with the following specifications for test purposes:

3 foot diameter balloons, no attachments excepting an inflation tube or appendix made of the balloon film about 10 inches long and 1.4" diameter.

2 each made from Polyethylene PM-1 film .004" thick
2 each made from Polyethylene PM-1 film .008" thick
2 each made from Saran type M film .00225" thick

15 foot diameter balloons with inflation tube 4" in diameter and 12" long, also means for attaching rigging lines supporting a 25-pound load to bottom of balloon and means for attaching auxiliary lifting balloons to top of balloon. If possible, balloon should be capable of withstanding internal pressure equivalent to 2" water.

5 each made from Polyethylene PM-1 film .004" thick
5 each made from Polyethylene PM-1 film .008" thick
5 each made from Saran Type M film .00225" thick

(1) The balloon film should be treated before or after manufacture in such a way as to seal all pinholes.

(2) A patching kit should be furnished for use of the balloon flight personnel.

(3) It is desired that either the volume of the 15 foot balloons be known to within 10 to 20 cubic feet when fully inflated or that the volume, though unknown, be nearly the same for each of the balloons of this size (differences in volume should not exceed $\pm 1\%$ of the total volume of a mean balloon).

Delivery was made 20 April 1947 on the first 3 foot balloons, two 15 foot balloons are expected by the end of May.

In an attempt to interest another manufacturer in the problem, the following companies were contacted.

Company	Type of Company	Interested?	Disposition
Dobeckman Co. 500 Fifth Avenue, NYC	Plastics & Packaging	No	None
Kennedy Car Liner & Bag Co., Shelbyville, Ind.	Plastics & Packaging	No	None

Plextron Inc. 55 Tremont Ave., Bx 57	Beach Balls	No	None
DuPage Plastics Co. 475 Fifth Ave., NYC	Beach Balls	No	None
Shellmar Products Inc. Empire State Bldg., NYC	Plastics & Packaging	No	None
Millprint Inc. Milwaukee 1, Wisconsin	Plastics & Packaging	No	None
Celanese Plastics Corp. 180 Madison Ave., NYC	Plastics & Packaging	No	None
E. L. Cournand Co. 2835 9th Ave., NYC	Plastics & Packaging	No	None
Bland Charnas Co. 24 Ashburton Ave,Yonkers	Toys, Beach Balls	No	None
Western Products Inc. Newark, Ohio	Plastics & Packaging	No	None
Rowe Packaging Co. 26 Queens St. E. Toronto 1, Ontario Canada	Plastics & Packaging	No	None
Goodyear Tire & Rubber Co., Akron 16, Ohio	Blimps & Balloons	Yes	Awaiting final decision.
Molded Latex Products Inc., 27 Kentucky Ave. Paterson 3, N. J.	Balloons (Meteorological)	Not very.	None
Air Cruisers Inc. Clifton, N. J.	Balloons (Meteorological)	Yes	Awaiting final decision.
General Mills Inc. 1837 Pierce St. N.E. Minneapolis 13, Minn.	Balloons (Picard's)	Yes	Awaiting visit.
Seyfang Laboratories 1300 Mediterranean Ave. Atlantic City, N. J.	Barrage Captive & Other Balloons	Yes	Awaiting final decision.
Dewey & Almy Company Cambridge 40, Mass.	Meteorological Balloons	No	None

On completion of the survey of balloon materials other orders will be placed for experimental intermediate balloons.

As soon as a series of successful flights are obtained, it is planned to procure balloons of about 8 times the displacement of the intermediate size for tests as the model to solve the problem. These larger balloons would be about 30 feet in diameter.

Altitude Control

Mr. Goudy of the Kollsman Instrument Division of Square D Corporation was contacted to determine the feasibility of:

(1) An accurate pressure-actuated liquid ballast dropping device.

(2) A motor-switched modulator for the standard Army radiosonde AN/SMT-1. The standard pressure-switched modulator would be of little value in determining the height of the constant level balloon after it leveled off on a constant pressure surface.

On a subcontract Kollsman undertook to build a pressure actuated "dribbler" or ballast dropping device as follows:

Mechanically Controlled Dribbler

To consist of a diaphragm operated needle valve which will allow no flow for a 2 mb. increase in pressure on the diaphragm over pressure of which diaphragm is sealed but will allow a flow of 40 grams/minute under 1 foot of lead for a 5 mb. increase in pressure. Petroleum ballast with a density of about .775 gm/cc is to be used.

Diaphragm to be open to the atmosphere until it is sealed off by the radiosonde pressure switch at a preset altitude.

An electrically operated needle valve was included in the order, however it is to be cancelled as the mechanical valve appears more feasible to the manufacturer.

As the motor switched modulator was already in experimental state of manufacture for the Signal Corps and Evans Signal Laboratories an order was placed for 3 of them with these characteristics:

To have a motor-driven commutator to contain 4 contacts alternately switching two different temperatures, pressure and a reference. Rate of switching will complete one cycle per minute. To report pressure accurately between 150 and 500 mb. with a pressure resistor to be of such a valve that with a large radiosonde frequency variation for a small change in pressure.

To have an adjustable contact variable between 250 mb and 400 mb with a factory adjustment of 300 mb. When the pressure arm reached this contact, a squib will cut a thread that holds the ballast diaphragm open.

The first mechanical dribbler was received on 20 April 1947 and is undergoing modification and tests before being flown on Cluster Flight #2. If it is successful, an order for improved models will be placed.

Another method maintaining a balloon at constant altitude is by replenishing the hydrogen in the non-extensible envelope as it is valved or as it diffuses. This might be accomplished by use of liquid hydrogen but not by use of chemicals due to their great weight relative to the small volume of hydrogen generated. The liquid hydrogen method is being investigated with a long range view. It does not seem too feasible, however, due to the difficulties of keeping the rate of evaporation of the liquid hydrogen low at the high altitudes, without extensive and heavy guard flasks of liquid air.

A third method of holding the equipment at a nominal constant altitude is to fly a cluster of standard meteorological balloons equipped with ballast dropping devices and a device for releasing lifting balloons should the cluster depart from the altitude limits desired. This method is inherently unstable, as there are no proportional restoring forces which will act on the flabby, freely extensible meteorological balloons. The success of this procedure depends on very careful balancing of the load against the variable lift of the balloons.

This cluster method is of use and interest only as a stop-gap method of lifting the Army equipment to altitude now, and has been the method used while awaiting delivery of the non-extensible plastic balloons.

III d) e. A flight was made on 3 April 1947 using this method. A cluster of 12 balloons meteorological carrying a radiosonde, a 15 lb. dummy load and a series of ballast dropping devices was released from the football field at Lehigh University, Bethlehem, Pa. The train was to be towed to 30,000 ft. by 2 lifting balloons which would then be cut loose. The weight of the equipment was adjusted to equal the lift of the balloons and presumably the train should have floated after the towing balloons were cut off. Actually, due to lack of experience in the difficulty of handling long balloon trains, auxiliary rigging lines were needed to take up launching stresses. These lines fouled the main flying line and the ballast which was to be dropped on parachutes. As a result, the balloon train went to 50,000 ft. where the tow balloons worked themselves free. The remaining train thereupon descended as fast as it had climbed (1,000 ft. per minute), landing in the ocean near Sandy Hook,

N. J. The flight was of value in training personnel, establishing a net for reception of the 74 megacyle radiosonde data, and in obtaining familiarity with the type of operation peculiar to all large balloon flights. The actual layout of the train used is sketched in the appendix.

Using the lessons learned on the dummy flight, improved equipment was built for a flight with a payload. Release was attempted on 18 April. Due to the high wind at 0830 EST, the time of release, and due to malfunctioning of the Army receiver in the plane that was to follow the balloons, release was not made. The already-inflated balloons were cut free and the equipment was brought back to New York University. It is expected that this equipment will be flown about 8 May. A description of the final flight equipment will be given in the report for May. A sketch of the layout of equipment built for the second cluster flight is given in the appendix. As this is a stop-gap method using modified standard components, no detailed report is being prepared on the equipment. Preliminary altitude controls used in both flights consist of standard radiosonde modulators ML-310 which have had leads taken off of the desired contacts of the commutator. The modulator thus acts as a pressure actuated control that releases ballast or balloons. In the first flight small radiosonde relays were used to close circuits to burn off cans filled with ballast. In the improved, second flight, a nest of plastic tubes were filled with dried sand. The bottom of the tube was covered with paper and a DuPont type S64 Squib was placed on the paper under the sand. On firing the squib, a hole is torn in the paper, permitting the sand to trickle out. This method permits dropping of more ballast and yet, in smaller increments. In the

second cluster flight, provision was also made to release balloons if the train rose above 40,000 ft. The flying line in the second train was approximately 500 ft. long.

This cluster flight is tedious to prepare and difficult to launch, and is a greater hazard to aircraft than the plastic balloons will be because of the great length of the cluster train.

III e) Apparatus and Equipment.

A detailed explanation is not given on the equipment of the Cluster Flight. However, a layout sketch is enclosed in the appendix. An important piece of new apparatus for this project is the ballast valve or dribbler, a photograph and drawings of which appears in the appendix. It consists of a special diaphragm which operates a needle valve. Normally the valve is closed as the diaphragm is open to the air before the balloon reaches the desired altitude. This allows the pressure inside the diaphragm to be the same as the outside pressure. The diaphragm is sealed electrically by the baroswitch of the flight radiosonde when the balloon train passes a predetermined altitude. Whenever the balloon train descends below this preset altitude, the increase of pressure on the sealed diaphragm causes the needle valve to be opened. The greater the excess in pressure on the diaphragm the more ballast there is released through the valve. Thus a proportional restoring force is applied to the train. The ballast that is to be used is a petroleum cut boiling from 300° to 400°F with a density of about .78 and a minimum change of viscosity with temperature. Two different type fluids that may meet this specification are the Army type compass fluid

and a Sinclair paint solvent. The ballast valve or dribbler essentially perform the same function as the Japanese altitude control on the balloon bombs yet it is simpler and permits use of a liquid ballast for better control.

Another piece of equipment that is under construction by Kollsman Instrument Company is a motor-switched radiosonde modulator. It presents pressure data to the radiosonde transmitter as a variable resistance. The meteorological data is programmed by a samll Brailsford Electric motor. This modulator will provide the contact that seals off the diaphragm in the ballast valve. A complete discussion of this equipment will be furnished upon its delivery.

Sketches of balloon and rigging of the balloon to be used on to the main problem are given in the appendix and are self-explanatory.

Computations

A chart showing the relation between altitude, gross lift, and balloon size has been found necessary.

Data for it was computed using mean aerological soundings as reported in the Monthly Weather review for 1943.

A chemical term, molar volume (in cubic feet) was used as a term relating the sounding data with buoyancies of the balloons at various altitudes.

Using the simple gas laws, the molar volume of dry air was computed thus:

I. (1) Molar volume of any gas at standard conditions is 359 ft.^{3}

(2) From Monthly Weather Review Jan. 1943, the mean sounding data at 15 km for Lakehurst, N. J. is: Temperature -59.5°C

Pressure 120 mb.

$$359 \times \frac{273.2 - 59.5}{273.2} \times \frac{1013.3}{120} \approx 2370 \text{ ft.}^3$$ (the mean molar volume at 15 km for Jan.1943 over Lakehurst,N.J.)

This volume data was computed for all lovels given. Data was "borrowed" from other stations in the same latitude to piece out the 20 km soundings as needed.

II. Lifts were computed for various molor volumes for balloons between 7.5 and 75 feet diameter in the following manner:

Given

purity of Hydrogen 99.7%
impurity as oxygen 0.3%
computed molecular wt. 2.11 #1 mol
Molecular weight of dry air as computed from data reported at 10 km. in Handbook of Chemistry and Physics.
28.764 #1 mol

To find the lift of a 20'^{D} balloon at an altitude where the molar volume is 1000 ft.^{3}:
Volume 20 ft.^{D} Balloon = 4190 ft.^{3}

$$\text{Lift/Balloon} \frac{\text{Balloon Volume X(Difference in molecular wgts.of air\#hgn}}{\text{Molar Volume at a given altitude}}$$

or

$$\text{Total Lift of gas in \#/Balloon} = \frac{\text{ft.}^3\text{/Balloon X (} \quad \text{\#/mol)}}{\text{ft.}^3\text{/mol}}$$

for the 20 foot diameter balloon:

$$\text{Lift} = \frac{4190\ (28.76 - 2.11)}{1000} = 111.7\text{\#}$$ lift from a 20 foot diameter sphere of hydrogen at an altitude where the molar volume is 1000 ft.^{3}.

The lifts were plotted against molar volume for each size balloon. The altitudes corresponding to various molar volumes for Lakehurst and Albuquerque in January and in August 1943 as computed above were plotted on the left margin of the chart.

The family of curves was plotted on log paper and is included in the appendix with the basic sounding data.

III g) Conclusions and Recommendations.

It is believed that a balloon can be kept at nominal constant altitude between 10 and 20 km. for six hours using a non-extensible envelope with the addition of a ballast valve to keep the balloon near its pressure altitude. The flying of a balloon thus equipped is our main objective. The work to date has been primarily preparatory but it is believed that plastic balloons can be flown in the early summer with a payload.

Additional work space is urgently needed at New York University if significant work is to come from this group.

It is believed that the ideal launching area for balloons of this type is Lehigh University, Bethlehem, Pa. as long as this is feasible, For large balloons it is believed that the Navy people at Lakehurst can best facilitate the launching. Calm winds are essential for actual launching.

Future Work

General Mills is making large balloons from lightweight films that would meet our specifications with the exception that they cannot take any internal pressure. It is believed that their balloons should be investigated as General Mills appear to be the best source of supply for large balloons. An order will be placed with them as soon as they furnish a quotation.

As a stop-gap device before these might arrive it is planned to fly two 35,000 cu.ft. racing type as well as the 2 Japanese balloons from Dakehurst, N. J. carrying payloads with heavy duty power supplies for the radio transmitters.

In the meantime, improved clusters of meteorological balloons will be flown until larger balloons are available.

C O P Y

Abstract from:

AIR COORDINATING COMMITTEE
NEW YORK SUBCOMMITTEE ON AIRSPACE
RULES OF THE AIR AND AIR TRAFFIC CONTROL
385 Madison Avenue
New York, 17, N. Y.

N.Y. Meeting No. 12 — 20 March 1947

PROBLEM:

1. The Secretary of the Subcommittee presented a request from the War Department member in behalf of New York University for approval to release free balloons from Allentown, Pa. and Lakehurst, N. J.

DISCUSSION

2. The subject project is broken down into two phases as described below:

A. PHASE I.

(1) The type balloon to be used in this phase of the project will be 6 ft. in diameter, hydrogen filled, encompassed by a nylong shroud with black and white panels 24" wide. Radio instruments weighing approximately 3 lbs. will be suspended approximately 50 ft. below the balloon and equipped with parachute device so that upon separation from the balloon, the attached equipment will float down towards the earth rather than become a freely falling body.

(2) It is anticipated that two flights will be required in this phase of operation, the release to be made during weather conditions in which the sky is free of clouds and the visibility at least three miles at all altitudes up to 20,000 feet., within a four hour cruising radius from Allentown, Pa.

(3) The balloon, during these flights, shall be convoyed by suitable aircraft to maintain air-ground communications on the balloon trajectory and equipped to effect destruction of the balloon at the termination of four hours flight or at such time that the balloon may become hazardous either to aircraft flight operations or the persons or property of others on the surface.

(4) New York University will file a Notice to Airmen at least twelve (12) hours in advance of balloon release and a second notice will be filed at the time of release with the Allentown, Pa. Airways Communications Station.

B. PHASE II.

(1) The type balloon to be used in this phase of the project will be a 15 to 40 ft. diameter plastic balloon, hydrogen filled. Radio equipment weighing approximately 25 lbs., will be suspended approximately 100 ft. below the balloon. The balloon will be towed to high altitude levels (above 20,000 feet) by three auxilliary lifting balloons fastened together with a 4 lb. weight. All equipment attached to the balloon will be equipped with parachute device so that upon separation from the balloon, the attached equipment will float down towards the earth rather than become a freely falling body. Upon attaining the desired altitude, the auxilliary lifting balloons wife be released from the main balloon.

(2) It is anticipated that a maximum of ten flights will be required in this phase of operation, 2 to 5 releases to be made from Allentown, Pa. and 2 to 5 releases to be made from Lakehurst, N. J. Release will be made during weather conditions in which the sky is free of clouds and the visibility at least three miles at all altitudes up to 20,000 feet.

(3) The range of flight during this phase of operation will bebetween 30,000 and 60,000 feet. A period of six hours will be the maximum duration of flight.

(4) New York University will provide an operator for tracking of the balloon during period of flight and will furnished information on its position to the N. Y. Air Traffic Control Center during period of flight.

(5) New York University will file a Notice to Airmen at least twelve (12) hours in advance of balloon release and a second notice will be filed at time of release with either the Allentown, Pa. or Lakehurst, N. J. Communications Stations.

(6) Destruction of the balloon will be predetermined to be effected over water where hazards are not present. Aerial convoy will not be effected during this phase of operation inasmuch as balloon flights will be conducted in excess of 20,000 feet.

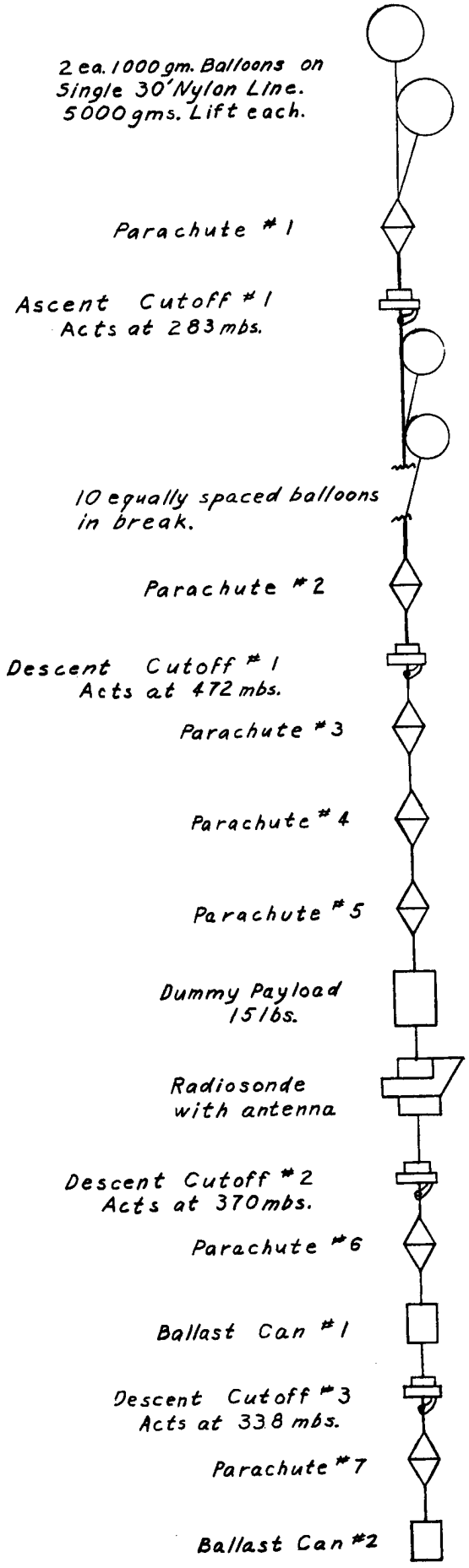
3. The War Department member requests that balloon operations along the lines of Phase II be presented to the Washington Subcommittee for clearance with all other Regional Airspace Subcommittees, in consideration of War Department plans to continue the Phase II type of operation from White Sands, New Mexico, upon completion of the 12 proposed releases described herein. The type of balloon releases proposed out of White Sands, N. Mex., will involve flight through other regions.

RECOMMENDED ACTION

4. That the release of free balloons by New York University as described above in Paragraph 2-A (Phase I), Subparagraphs (1) - (4) inclusive, be approved.

5. That the release of free balloons by New York University as described above in Paragraph 2-B (Phase II), Subparagraphs (1) - (6) inclusive, be approved.

6. That the Washington Airspace Subcommittee present the Phase II operation to other Regional Airspace Subcommittees for clearance, in view of War Department plans to continue the Phase II type of operation from White Sands, New Mexico.



All individual balloons on single 15' Nylon lines and tied onto Main Line at 20' intervals.

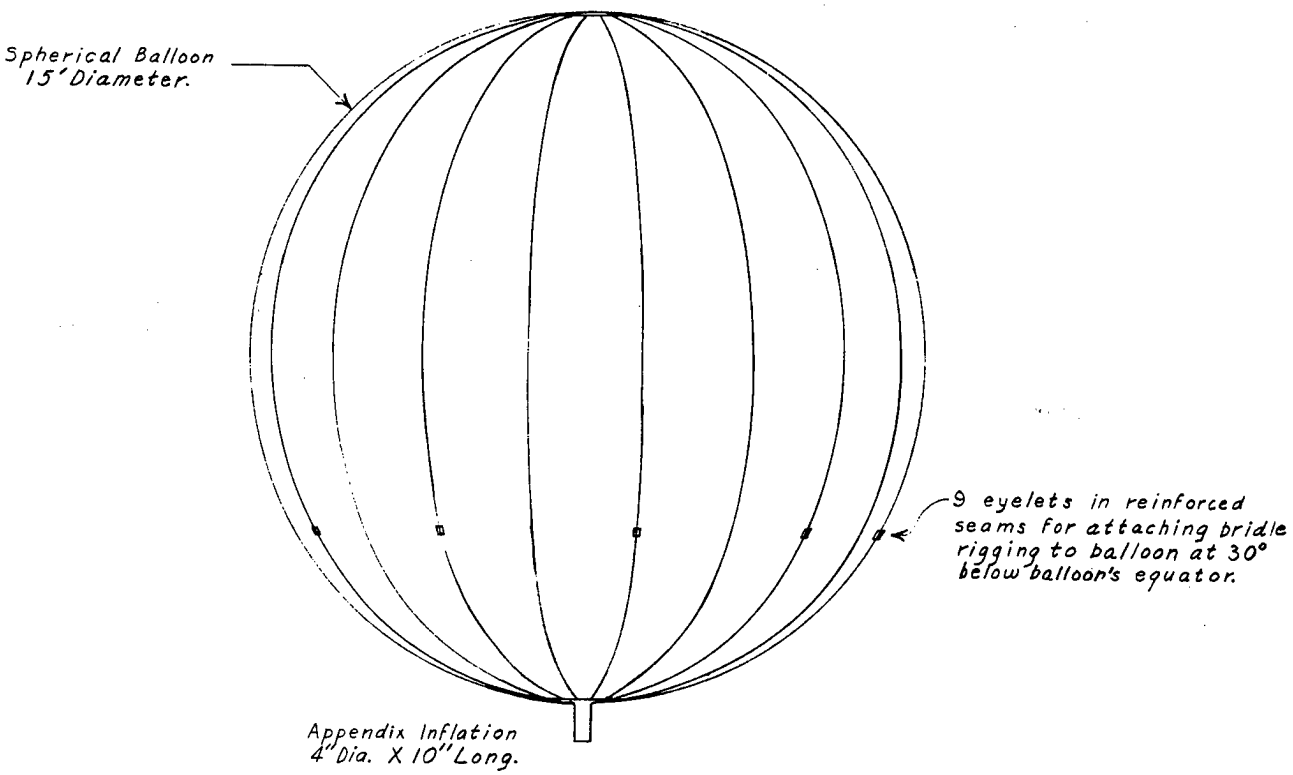
Flying line from Cutoff # 1 to Parachute # 2 is braided for added strength.

There is a distance of 5' between each piece of equipment, except the 20' between balloons on the Main Flying Line.

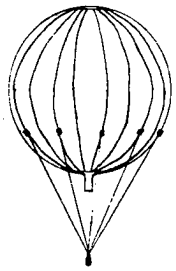
The 12 balloons on the braided line are each 350 gm. balloons with a lift of 1550 gms. each.

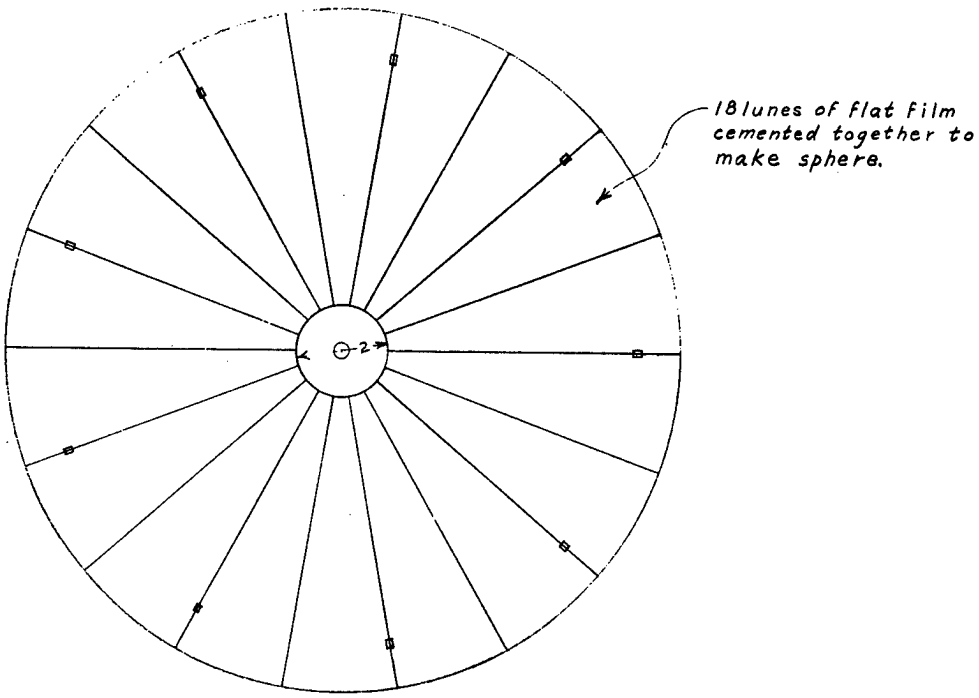
BALLOON TRAIN FOR CLUSTER FLIGHT NO. 1

BETHLEHEM, PENNA.
3 APRIL 47.



Balloon with rigging



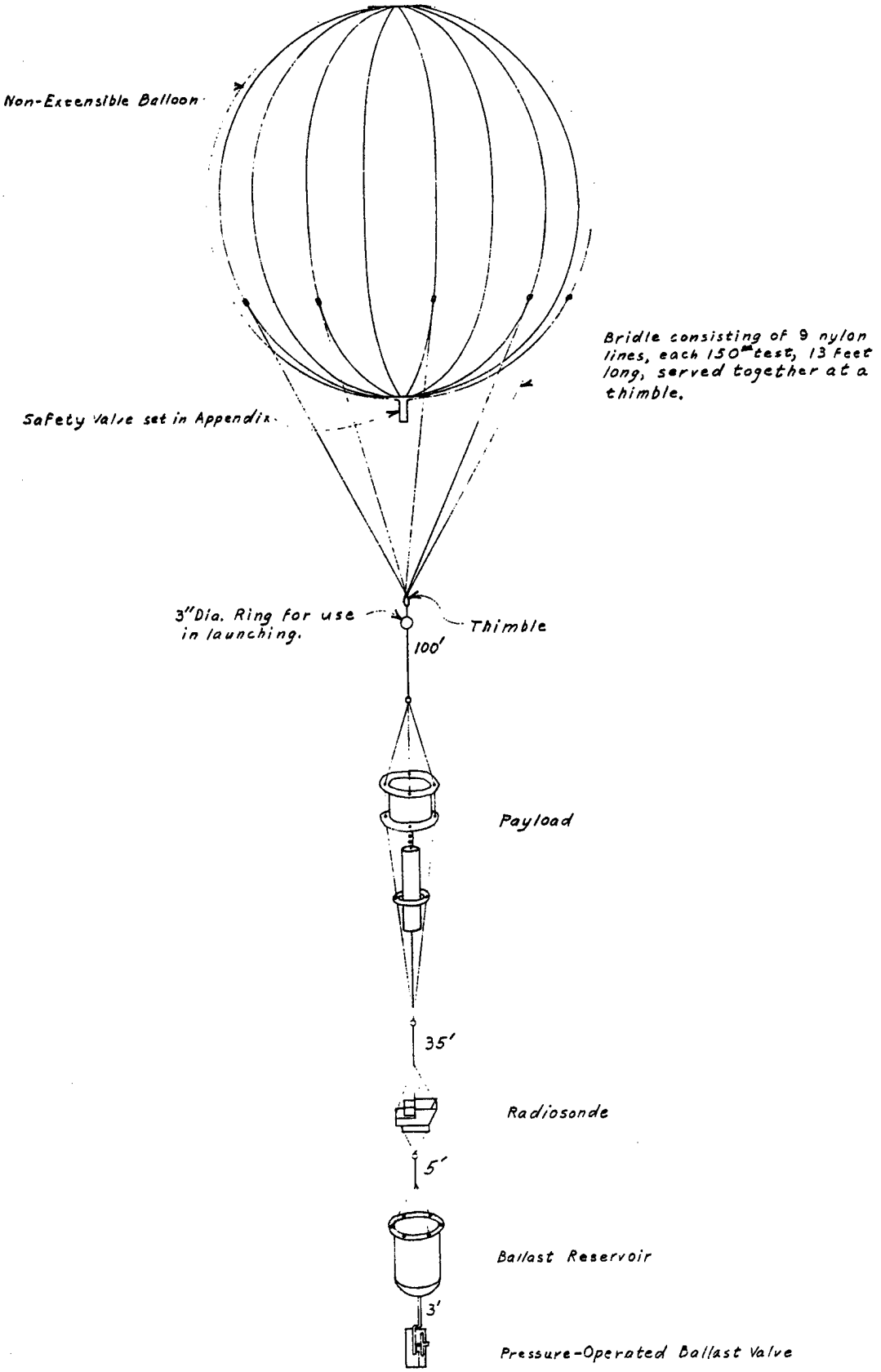


PLASTIC BALLOON

FOR CONSTANT LEVEL BALLOON PROJECT AT NYU

APRIL 27, 1947

SCALE: 1"= 3'0"



PROPOSED ASSEMBLY OF
TRAIN FOR CONSTANT LEVEL BALLOON

APRIL 27, 1947 SMITH, JAMES E.

LAKEHURST (39 meters)

	JANUARY 43				AUGUST 43 -				
Alt.Ft.	Temp.°C	Press mb	Humidity%	Molar Vol. ft.^{3}	Temp.°C	Press mb	Humidity%	Molar Vol.ft^3	Alt.Ft.
65,617	-58	53	—	5410	- 64	58	--	4850	65,617
62,336	--	--	--	--	--	--	--	--	62,336
59,055	--	--	--	--	212.0 - 61.2	79	--	3585	59,055
55,774	--	--	--	--	337.2 - 64.2	94	--	2962	55,774
52,493	--	--	--	--	338.6 - 65.6	110	--	2370	52,493
49,212	213.7 -59.5	120	—	2370	337.1 - 64.1	130	--	2150	49,212
45,931	215.8 -57.4	140	—	2050	333.7 - 60.7	153	--	1845	45,931
42,651	216.3 -56.9	164	—	1808	329.4 - 56.9	179	--	1630	42,651
39,370	217.2 -56.0	192	—	1506	304.0 - 51.2	209	--	1440	39,370
36,089	-54.1	224	—	1339	318.0 - 45.3	243	--	1250	36,089
32,808	-51.0	262	—	1130	311.2 - 38.2	282	--	1115	32,808
28,527	-45.5	304	—	995	303.4 - 30.4	325	--	1000	28,527
26,247	-38.8	352	—	888	296.0 - 23.8	374	--	890	26,247
22,966	1 -32.1	408	—	788	290.0 - 17.0	428	--	800	22,966
19,685	248.2 -25.0	469	—	705	283.1 - 10.1	488	31	718	19,685
16,409	254.3 -18.9	536	60	632	276.9 - 3.9	555	28	650	16,409
13,123	-13.0	611	59	566	1.5	629	38	582	13,123
9,843	- 8.5	696	60	507	6.4	711	49	523	9,853
8,202	- 6.4	742	61	478	9.0	756	51	499	8,202
6,561	- 4.5	791	65	453	11.9	802	55	474	6,561
4,921	- 3.2	843	69	427	15.0	852	63	452	4,921
3,281	- 2.5	898	68	401	18.6	903	58	432	3,281
1,640	- 1.7	956	69	378	21.7	956	60	413	1,640
0	- 1.0	1013	76	359	21.5	1008	76	385.9	0

ALBUQUERQUE (1620 meters)

- JANUARY 43					- AUGUST 43 -				
Alt.Ft.	Temp.°C	Press mb	Humidity%	Molar Vol.ft.^{3}	Temp.°C	Press mb	Humidity%	Molar Vol.ft.^{3}	Alt.Ft
65,617	-63	54	--	5410	-58.1	58	--	4960	65,617
62,336	--	--	--	--	--	--	--	--	62,336
59,055	-65.1	75	--	3701	--	--	--	--	59,055
55,774	-64.3	88	--	3170	-70.0	96	--	2830	55,774
52,493	-63.0	104	--	2700	-69.8	114	--	2430	52,493
49,212	-61.6	122	--	2320	-66.4	134	--	2060	49,212
45,932	-60.2	143	--	1990	-61.5	138	--	1780	45,932
47,651	-54.1	168	--	1690	-54.7	186	--	1560	47,641
39,370	-57.2	197	--	1450	-47.0	217	--	1390	39,370
36,089	-54.7	230	--	1250	-39.4	251	--	1250	36,089
32,808	-49.7	269	--	1140	-31.6	290	--	1110	32,808
29,527	-43.0	312	--	983	-24.2	333	45	980	29,527
26,247	-35.7	362	39	872	-17.1	382	45	895	26,247
22,966	-28.3	416	45	786	-11.0	436	56	803	22,966
19,685	-21.2	477	48	704	- 5.6	495	72	715	19,685
16,404	-14.6	546	50	631	1.1	562	79	652	16,404
13,123	- 8.3	622	51	567	3.8	634	66	594	13,123
9,843	- 2.6	706	48	522	16.6	715	48	541	9,843
8,202	.6	752	45	486	20.4	758	44	517	8,202
6,562	3.4	800	46	463	23.3	803	39	492	6,562
0	3.8	838	45	449	25.2	838	44	480	0

5fc 1620 meters = 5315 feet

Fiscal Report As of April 30th, 1947

Total amount expended	$20,067.96
Available Balance	97,632.04
Total	$117,700.00